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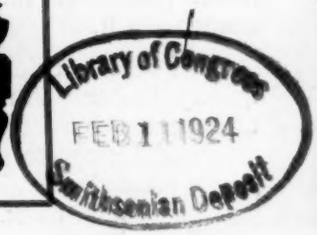

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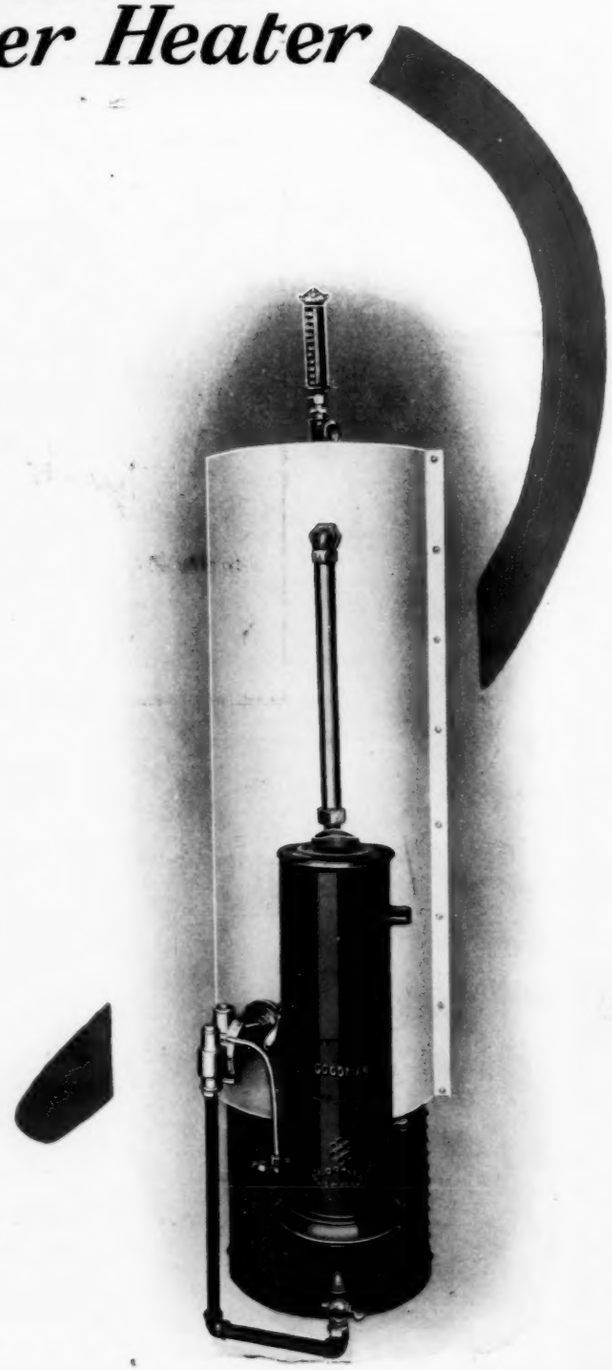

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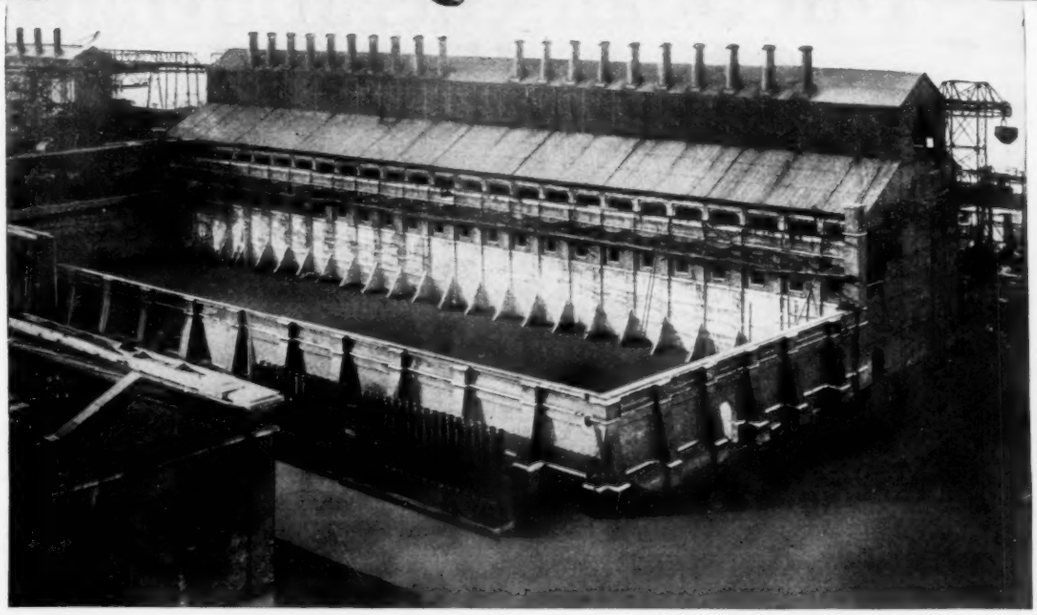

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American Gas Journal

SIXTY FIFTH YEAR

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Making Water Gas from Bituminous Coking Coal

The conditions under which the gas can be made

W. W. Odell

The importance of this paper lies in the fact that it is a thorough study of the conditions underlying the use of bituminous coking coal, a cheap coal, for the manufacture of water gas. The prevailing high prices of coke, anthracite and gas oil and the apparent tendency towards still higher prices give this investigation great timely significance. It is becoming increasingly necessary to use cheaper fuels in gas manufacture.

This article is part of an abstract of a report published by the Bureau of Mines as Technical Paper No. 274.

Central District bituminous coals have been used to some extent during the past few years in Illinois and the surrounding states as water-gas generator fuel. The results obtained were encouraging enough to warrant further study of prevailing conditions and their causes, with the object of determining what changes in the construction of a water-gas set might be made to permit greater economies in the use of bituminous coal as generator fuel. The desirability of making as few changes as possible and of using present equipment as far as possible is recognized and has been kept in mind during the course of this study. High prices of oil and of coke and the tendency toward still higher prices increase the advisability of giving due consideration to this subject.

Difficulties of Using Central District Coal

Some of the bothersome obstacles that are of chief concern in the use of bituminous coal are enumerated below:

1. The coal, on coking, cakes and arches in the upper part of the generator.
2. For a given set of blasting conditions, there is a decrease in the volume of air that can be injected into the fuel on blasting.
3. Gas-making capacity is reduced, primarily because of the coking and arching of the coal and the lessened volume of the air that can be injected.
4. The volume and the heating value of the blast gas are increased on a given amount of blasting.
5. More fuel is used per 1,000 cubic feet of gas made.
6. Miscellaneous difficulties are encountered, including the formation of flues in the fuel bed, clinker troubles, smoke nuisance, sticking of valves, and sometimes carbon troubles.

Factors in Successful Operation

For the successful use of coal generator fuel, it is first desirable to (1) heat the fuel more quickly or completely, (2) to utilize the heat of combustion of all the blast gas, (3) to increase the capacity, that is, make more gas per run, (4) to use in the finished gas as much of the volatile matter from the coal as possible, (5) to avoid the excessive formation of side clinkers or "edgings," (6) to eliminate excessive deposits of carbon in the carburetor, and (7) to use less fuel and steam per thousand feet of gas made.

Overcoming Difficulties of Operation with Coal

Some of the listed difficulties have been partly remedied, although not in an altogether satisfactory manner. The first four are overcome in part by the blow-run method of operating, which was instituted by the writer during the Streator experiments described in Bulletin 203 of the Bureau of Mines. This method consists of burning all the combustible blast gas in the checker chambers during blasting until the latter are hot enough for gas making, then closing the stack lid and continuing the generator blast for a determined fraction of a minute, allowing the producer gas generated to pass into the holder. The steam run is then made in the usual manner.

An increased percentage of down runs is the only means so far adopted to alleviate troubles from edgings and to bring the clinkers down to the grates. This method is of course most satisfactory for fuels with ash of the lowest fusion point.

Economy Effected with Coal as Generator Fuel

Results already obtained with coal as generator fuel show that a marked saving can be effected; that is, with war time prices for coke, oil and coal, the cost of making 1,000 feet of gas will be less when coal is used. With the present prices of "gas-oil" and coke, the continued economy that can be realized by substituting coal for coke is evident. Figure 1 shows the possible economy in the use of coal as compared with coke fuel. No allowance has been made for differences in capacity, purification, or air requirements with different fuels. These differences will necessarily have to be considered separately for each individual plant, since at some plants the capacity is not reduced during operation with coal and in others a reduction of 10 to 20 per cent is noted. In the latter the actual operating cost is higher per thousand feet, and there is a corresponding reduction in the possible saving per thousand feet. The data given in Figure 1 are based on the use of 33 pounds of coke per thousand feet, as compared with 40 pounds of coal per thousand feet when the blow-run method of operating is used. The air and steam requirements are considered as alike for each fuel. The oil per thousand feet with coke fuel is taken as 3.2 gallons; with coal fuel, 3 gallons.

This difference in oil requirements can be obtained with the blow-run method of operating, but with the regular method of operating the difference in favor of coal fuel is three-tenths of a gallon. In the latter instance, however, the capacity is materially reduced when comparison is made with the results obtained with Eastern coke.

According to Figure 1, it is evident that in plants remote from a source of supply of good oven coke, but close to a source of supply of a cheap, suitable coal, the use of coal in the generator is particularly indicated.

Methods of Overcoming Present Difficulties of Operation

From the foregoing, the seat of the troubles encountered when using coal fuel is obviously in the generator. Since the volume of water gas produced during the run depends upon the temperature and the volume of the incandescent fuel and upon the time of contact of the steam with the fuel, any improvement or increase of output of blue gas must come chiefly from changes in these conditions.

Depth of Fuel Bed

When a change in the depth of the fuel bed is considered, the conditions desirable for making a steam run seem quite the opposite of those best suited for blasting. In order to produce blue gas containing a minimum amount of CO_2 by the reaction $C+H_2O=CO+H_2$ with but little of reaction $C+2H_2O=CO_2+2H_2$ taking place, it is desirable to have as deep a fuel bed as practicable heated to as high a temperature as feasible. On the other hand, to produce the least possible amount of CO during blasting, it is desirable to have as shallow a fuel bed as possible and to blast as rapidly as possible. For making a gas of high heating value from high carbon value, the combination found in common practice has proved quite satisfactory; that is, all the combustible blast gas produced on blasting the fuel to the desired temperature is required to heat the checker chambers enough to crack the oil. When the gas standard is lowered more combustible blast gas is produced than is required. A high-volatile fuel increases the production of such gas enough to impair the efficiency of operation. Decreasing the depth of the fuel bed and increasing the rate of the blast would perhaps benefit this condition, but it would simultaneously further reduce the gas-making capacity, since it is not feasible to shorten materially the operating cycle. In fact, the opposite result is sought; that is, an increased capacity. When the fuel bed is deepened somewhat, it offers greater resistance to the introduction of air and there is more combustible matter in the blast gas, although the gas-making capacity is perhaps slightly increased. Neither of these changes in the depth of the fuel bed seems to solve the problem.

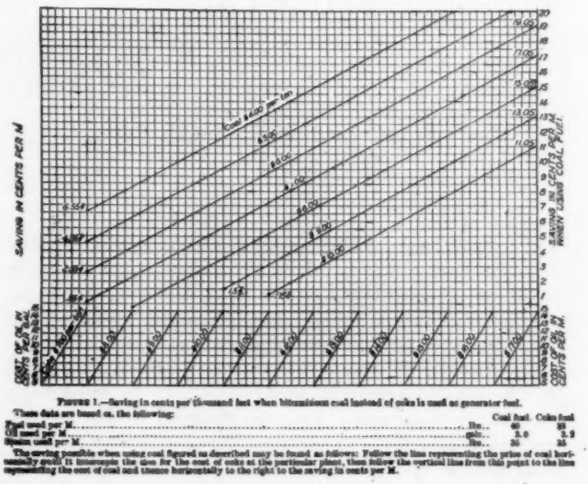


FIGURE 1.—Saving in cents per thousand feet when bituminous coal instead of coke is used as generator fuel.

These data are based on the following:

	Coal fuel	Coke fuel
Fuel used per M.	lbs.	40	33
Oil used per M.	gals.	3.0	3.2
Steam used per M.	lbs.	30	30

The saving possible when using coal figured as described may be found as follows: Follow the line representing the price of coal horizontally until it intersects the one for the cost of coke at the particular plant, then follow the vertical line from this point to the line representing the cost of coal and thence horizontally to the right to the saving in cents per M.

Volume of Fuel in Generator

One possible improvement of conditions without changing the depth of the fuel materially involves increasing the volume of fuel in the generator by increasing the internal diameter of the generator. This apparently would be of particular advantage when using coal fuel, for it increases the area of the zone of complete combustion, decreases the resistance to the introduction of a given quantity of air per minute, increases the quantity of heat stored in the generator for a given amount of blasting, and decreases the linear rate of travel of the fuel in the generator for a given rate of fuel consumption.

An oversize generator should permit the production of the normal amount of blue gas, when coal is

used, without unduly increasing the linear rate of travel of the fuel. It should accordingly offer an opportunity for the fuel in the upper part of the generator to become hotter.

Time of Contact—Temperature

The time of contact of the steam with the incandescent fuel is of importance and is best considered as a function of the temperature. Both the velocity and the completeness of the water-gas reaction increase with the temperature and with the time of contact. The time of contact required for the production of satisfactory blue gas increases very rapidly as the temperature decreases from 1,200 deg. C. (2,192 deg. F.). Slight changes in the temperature of the fuel below 1,200 deg. C. are decidedly more effective than slight changes in the time of contact. To obtain a material benefit from increasing the time of contact of the steam with the fuel would require such an increased fuel volume that the mechanical disadvantages would probably offset the benefits.

Obviously, the maximum temperature that can be conveniently used in water-gas generators is limited. Since the use of higher temperatures is neither necessary nor desirable it seems that the output of a set might more readily be augmented by increasing the percentage of high-temperature fuel in the generator, this being requisite for increasing the make with coal fuel. The increase may come from a change in methods of operating, an increase in the size of the generator, or a provision for air blasting the upper part of the fuel.

Up Runs and Down Runs

When coal is used, an increased number of down runs has been found necessary to prevent green fuel from passing out with the ash and to help keep side clinkers down. This is due chiefly to the difficulty of rapidly heating the coal, to the purely superficial heating of the partly coked coal, and to the practice of using excess steam during the run. Benefits have unquestionably been derived from this practice, although the make during a down run is not ordinarily as great as during an up run. In the writer's opinion, it would be preferable to make more up runs if the conditions in the generator could be regulated in another way. Any benefits that may be derived from forcing the tarry vapors down through fuel bed, as during down runs, are probably more than offset by the chilling of the green fuel—which should be heated as quickly as possible—and by the decreased make. The temperature of the gas leaving the generator is at a maximum during down runs, and considerable heat is absorbed from the fuel in the upper part of the generator.

Hot-Air Blast

The employment of hot-air blast has been suggested as desirable with coke fuel, but it is not considered feasible with iron grates. Conditions are so different, however, when coal is substituted for coke in the generator that, in the writer's opinion, the use of pre-heated air for blasting is not only desirable but is under certain conditions feasible. The additional heat generated in the lower part of the fuel bed would, it seems, eliminate the necessity of making so large a percentage of down runs, improve clinker conditions, or at least put the clinkers on the grate instead of on the generator wall, increase the gas-making capacity, and reduce to a minimum the percentage of fuel in the ash. Under these conditions, the fuel should carbonize earlier in its course through the generator and offer less resistance to the introduction of air during blasting.

Ash Softening Point—Relation to Up and Down Runs and to Side Clinkers

The fusion temperatures of coal ash have considerable influence on clinkering and an important bearing on operating results and on generator capacity.

Coal ash, being a mixture of a number of substances, does not have a single definite melting point. The gradual softening and fusion of the ash when heated is not merely the successive melting of the various ash constituents but a more complicated process involving the formation of new and more fusible compounds. It has been shown further that the softening point is affected by the amount and form of iron in the ash, by the rate of heating, and by the atmosphere in which the ash is heated. A number of tests showed that the maximum difference in softening temperatures due to different atmospheres ranged from 134 deg. to 396 deg. C. It is evident that through the reduction of the iron content to the metallic state a slag or fluid ash might freeze on passing from one zone to a slightly hotter zone of different atmosphere.

Excess Steam During the Run

The primary water-gas reaction may be written as follows:

C	+	H_2O	=	CO	+	H_2.
12 lbs.		18 lbs.		28 lbs.		2 lbs.

Equivalent at 60 deg. F. to 378 cu. ft. CO + 377 cu. ft. H_2=755 cu. ft. of gas.

The quantity of blue gas in 1,000 cubic feet of carburetted gas is not usually greater than this, although dependent on the quality of finished gas made; therefore it may be said in general that 18 pounds of steam are actually required per thousand feet of carburetted gas. During the run, however, as the temperature in the generator decreases, the quantity of steam that passes through the fuel undecomposed increases. A common figure for steam used per thousand feet, with coke fuel, is 35 pounds, practically 100 per cent in excess of that calculated above. When coal fuel is used, the tendency in ordinary practice has been toward a still greater excess. An excess over the 18 pounds per thousand feet is necessary and perhaps more desirable than it may seem on first consideration. A small

(Continued on page 131)

Annual Report of N. Y. Public Service Commission

THE Public Service Commission, in its annual report to the Legislature in its summary of orders issued by the Commission fixing rates were made applying to 32 companies supplying gas, including mixed, and to eight companies supplying natural gas.

The Commission in its report shows expeditiousness in disposing of cases pending before it. There were pending before the Commission on July 1, 1922, 441 formal applications and petitions. One year later, July 1, 1923, this balance of cases not acted upon had been reduced to 307, making a net gain in undisposed matters of 134. The July 1, 1923, balance of 307 cases was further reduced to 299 at the close of business December 31, 1923.

Special permission orders were issued during the year to 11 gas corporations under subdivision 12 of section 66 of the Public Service Commission Law.

The following statistics show the number of gas corporations under jurisdiction of the Commission on December 31, 1923, in the state:

Coal Gas or Water Gas Corporations:		
Operating	34	
Operating municipality	2	
Not operating, either inchoate or dormant	4	
Not operating lessor	1	
		41
Coal Gas or Water Gas and Electrical Corporations:		
Operating	40	
Not operating, either inchoate or dormant	4	
		44
Natural Gas Corporations:		
Operating	32	
Operating, unincorporated persons	8	
Not operating, either inchoate or dormant	1	
		41
Electrical and Natural Gas Corporations:		
Operating	3	
		3
Coal Gas and Natural Gas Corporations:		
Operating	2	
		2
Acetylene Gas Corporations:		
Operating	5	
Operating, unincorporated persons	1	
Operating municipalities	1	
		7
Gasoline Gas Corpoartions:		
Operating	3	
		3
Total of all Gas Corporations and Companies.		141

Name of Corporation	Bonds.	Stocks.	Notes.
Adirondack Power & Light Corporation	$4,250,000	$3,000,000	.....
Rochester Gas & Eelctric Corporation	4,000,000	1,000,000	.....
Long Island Lighting Company	1,500,000	4,385,000	.....
Kings County Lighting Company		1,500,000	.....
Iroquois Gas Corporation		5,000,000	.....
Northern New York Utilities, Inc	1,768,300	3,223,650	.....
Long Beach Gas Company	1,560,000	364,200	.....
Nassau & Suffolk Lighting Company	1,345,500	874,400	.....
Public Service Corporation of Long Island	1,036,200	227,900	.....
Utica Gas & Electric Company		1,280,000	.....
Queens Borough Gas & Electric Company	3,000,000	.....	.....
Brooklyn Borough Gas Company	2,000,000	500,000	.....
Brooklyn Edison Company, Inc		6,000,000	.....
Niagara Falls Power Company		2,600,000	.....
Empire Gas & Electric Company	360,000	213,300	.....
Niagara, Lockport & Ontario Power Company	661,000	.....	$3,000,000
Syracuse Lighting Company		1,500,000	.....
Staten Island Edison Corporation	5,307,800	.....	.....
New York Central Electric Corporation	2,000,000	1,689,500	.....
New York Steam Corporation		1,500,000	.....
Rochester Telephone Corporation	2,905,200	.....	.....
Boston & Maine Railroad	7,000,000	.....	2,115,000

In its annual report for the year 1922 it was stated that public utility corporations in the State of New York were availing themselves of the provisions of article 24, as amended, of the Stock Corporation Law which permits public utility corporations to issue stock without nominal or par value. During the present year the total authorization for stock without nominal or par value totalled $38,721,025, which was accounted for principally by the following issues:

Troy Gas Company	$3,323,600
Staten Island Edison Corporation	2,871,750
Consolidated Gas Company of New York	30,123,550

In addition to the above issues, the principal authorizations of securities during 1923 were as follows:

3. In relation to gas service and litigation resulting from gas legislation enacted in 1923, the Commission in its report has to say:

(Continued on page 122)

INDUSTRIAL GAS LESSONS

IF IT'S DONE WITH HEAT — YOU CAN DO IT BETTER WITH GAS

Lesson No. 6

The measurement of temperature (continued)

Hence the various methods of measuring temperature may be classified in accordance with the effect of the heat on the measuring body. Thus the effect of heat on a gas, for example, air, hydrogen, etc., can be utilized to measure temperature by noting the increase in volume under constant pressure conditions or the increase in pressure under constant volume conditions. This form of temperature-measuring instrument, or thermometer, is known as the gas thermometer. It is an instrument used sometimes in scientific work, but too bulky and difficult to manipulate to render its use practical in commercial work.

The Mercury and Alcohol Thermometer

Heat causes the volume of a liquid to increase, and this increase is constant, as the quantity of heat contained in the substance becomes greater. In other words, the expansion of the liquid is directly proportional to the temperature of the substance. This phenomenon forms the basis on which liquid thermometers are constructed. This class of temperature-measuring instruments is the most common of all as it embraces the mercury thermometer, as well as the alcohol thermometer, which is used at low temperatures at which the metal, mercury, cannot exist in the liquid condition, and freezes.

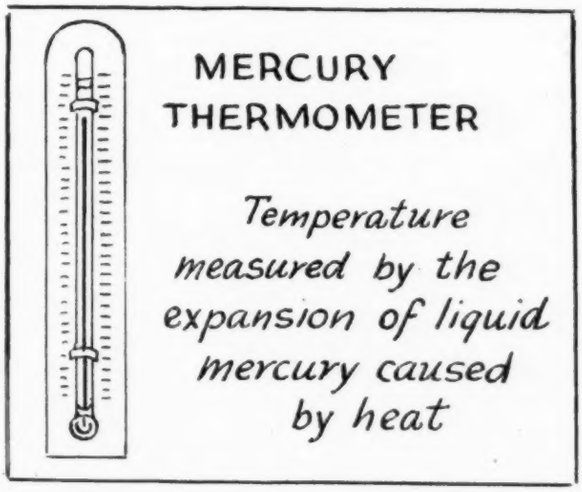
In this connection it must be pointed out that any thermometer possesses limits beyond which it cannot be employed in temperature measurement. There is both an upper and a lower limit, that is, a maximum temperature beyond which the instrument cannot be used, and a minimum temperature that can be read off the same. It is hence necessary to select the proper instrument to read the temperatures within the range that prevails.

Temperature Measurement by Expansion of a Solid

Temperature is also measured in mechanical devices of various sorts in which the heat causes the size or shape of an elastic body to change under constant pressure. This employs the well-known effect of heat, the expansion of metals, implying, of course, the contraction of the metal after the heat is removed. The instrument is made in such a manner that the solid is held fast and the stress induced in it by its tendency to expand under the influence of heat is used to move a pointer around a graduated scale.

Measuring Temperatures by Change in Viscosity.

It is known that the viscosity of a liquid decreases as the temperature rises. Viscosity is a measure of the "body" of a liquid, the ease with which it flows, a property which is commonly known as its thickness. The measurement of viscosity is simple, it being merely a comparison of the time required for a certain standard volume of the liquid to flow through a standard sized opening under strictly controlled conditions—particularly as relating to the temperature—and the corresponding time required for an equal volume of water to flow through the opening under the same conditions. The higher the temperature of the liquid, the less its viscosity; the relation between the two is capable of being expressed in mathematical terms. This enables the determination of the temperature from the viscosity of the liquid.

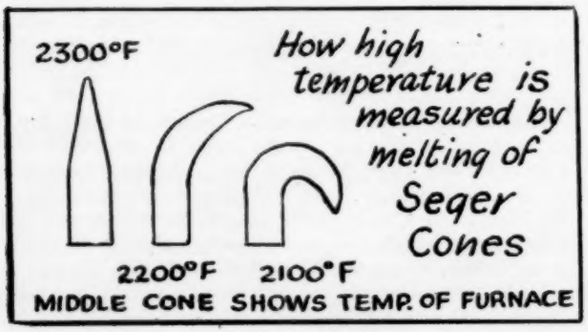


Temperature Determined by Fusion Point.

The fusion point of special alloys or mineral compositions is used to determine the temperature within industrial furnaces. This method is used for the measurement of high tempertaures and will be discussed in more detail later when considering the measurement of high temperatures.

Temperature Measured by Electrical Effects of Heat

The fact that heat will cause a current to flow in a combination of certain metallic conductors, known as a couple, is also taken advantage of in measuring high temperatures. The current may be read off a meter, the scale of which is graduated in degrees. The instrument is known as a thermocouple and is a very accurate device for temperature measurement. One form of the thermocouple is used for measuring temperatures which are too high for the ordinary



metallic couple. This instrument is known as the radiation thermo-couple, the radiant heat being reflected by means of mirror to the point of juncture of the two metals which form the couple. The magnetic effect of heat is also utilized in temperature measurement, which involves the change in the magnetism of a fixed magnet brought about by high temperatures.

Temperature and Color

Lastly, the temperature of an oven may be judged from the color of the firebrick lining. This method of determining temperature is, of course, applicable only to high temperatures and is dependent to a greater or less degree on the personal equation. There are certain standards which are followed in this practice which will be discussed in more detail under measurement of high temperature.

ANNUAL REPORT N. Y. PUBLIC SERVICE COMMISSION

(Continued from page 120)

Gas Service

The year's experience in the continued use of the present standard of 537 British Thermal Units per cubic foot has been satisfactory. Tests assiduously conducted have shown that the corporations engaged in selling gas to the public have conformed closely to this standard.

The question of capacity is one of the present most serious problems for the gas industry. It was anticipated that the general introduction of electricity would decrease the demand for gas, but instead there has been a steady increase in the demand, coming largely from industrial users. Just now another new demand is manifesting itself, that is, gas for house heating. It must be borne in mind that the convenience which comes with the use of gas, the relief of the customer from the necessity of keeping his coal bin or oil tank filled, the absence of dust and discomfort attendant upon ashes and the annual or periodic renewal of the coal supply, not to mention the anxiety such as was experienced during the coal strike in the early part of the year point unerringly to a coming demand which will be greater than the corporations can properly supply with their present capacities. This condition makes necessary an intensive study of plant conditions, distribution systems and rate structures and invites determinations on the part of those entrusted with the management of the properties in preparation for the future activities of the industry. Some of the corporations are testing the situation through trial rates and installations, and it is believed that these tests will serve to enforce the need for the immediate and comprehensive rehabilitation of many of the existing plants.

Gas meter testing continues to increase in direct proportion to the growth of the corporations. The house building boom which extended throughout the State has brought with it an excessive demand on the Commission's testing force. Over 508,000 gas meters have been tested by the Commission's employees during the year. Of this number, 435,000 were tested for use in the metropolitan district. This number includes many meters which have been repaired after havng been in service for the period deemed reasonable, which most of the corporations now set at seven years.

THE ATLANTIC CITY CONVENTION

With Atlantic City, New Jersey, chosen as the meeting place of the Sixth Annual Convention of the American Gas Association some time during the month of October, this year, N. T. Sellman and C. W. Berghorn, of the headquarters staff, visited the resort on January 9 and investigated conditions at the Steel Pier, where A. G. A. conventions for the last two years have been held.

They were agreeably surprised to hear from the executives of the Steel Pier Company that plans have already been made for erecting a permanent structure over the Steel Pier from the Casino to the ball room and therefore enclosing that part of the pier which was covered by canvas last year. Louis Burk, secretary and treasurer of the Pier Realty Holding Company, which controls the Steel and Garden Piers, stated that the new construction work would increase the seating capacity of the Steel Pier by at least 10,000 and would cost in the neighborhood of $100,000.

The new improvements are to be completed by April, it is stated. Although the American Gas Association has not decided definitely upon the Steel Pier for its 1924 meeting, it is believed that they will do so now that the Pier is to be improved in such a way as to enable the exhibition to be entirely under one permanent roof.—(From American Gas Association.)

As The Journal Views It

THE CHEAPEST GAS OF ALL

It is always gratifying to find that others look at things from the same angle as ourselves, especially when we feel and know that we are absolutely correct in our contentions. The gas industry is no exception to this rule, and in fact it is more than eager to learn that publications, particularly newspapers, and also the public at large, are sympathetic with its endeavors to secure a fair return for services rendered. Hence the editorial which follows, and which recently appeared in an issue of "The Sun and the Globe" of New York City, is indeed very pleasing reading to a gas man:

"Special Master Graham's tentative decision that the dollar gas law is unconstitutional will disappoint no one, and least of all the authors of the bill. It was porbably the most absurd measure passed by our 1923 Legislature. Fixing a maximum price of a dollar for all city gas, in place of the charge of $1.15 to $1.45 now made, it was enacted for political purposes only. The making of rates in such fields is properly a function of the Public Service Commission, for a Legislature cannot ascertain the facts. It is absurd to set a uniform rate for the whole city, since costs of production vary greatly in different boroughs. The law was made without proper study or debate, by men who were afraid to vote "no," but knew that the judges would have to accept the odium of declaring it unconstitutional.

"The cheapest gas we have is that emitted by demagogues who send such legislation, palpably blundering and confiscatory, to cause needless confusion and expense in our courts. They fool fewer people than they suppose."

There is no doubt about it, but that the very cheapest form of gas is that which comes out of the mouths of demagogues and interested politicians who are determined to obtain publicity for themselves by the time-honored, but no longer so-generally-practiced method of taking a fling at the gas or other public utility.

We have just a word to say in this respect. The people themselves must come to realize that introduction of illegal legislation and the passage of the same can only mean wastage of time and money on the part of both the gas company and the municipal and state authorities who try to enforce it. The people must also realize that the money that is spent by both parties in the litigation must be ultimately borne by them. Surely the gas companies cannot bear the expense, and certainly there is no way for the city to meet it except to obtain it from the taxpayers. It is, therefore, decidedly uneconomical, to say the least. to put legislation on the statute books of the State, which, on the face of it, is unconstitutional. The new gas law, which is still being fought in this State, is an example of such legislation, and the decision which is mentioned in the above editorial is a clear indication of what is going to happen to the entire law when it comes up before the Supreme Court.

It is about time that intelligent voters of the State see to it that their legislators do not try to foist legislation on the public which tends to a wasteful expenditure of the people's funds.

A MERCHANDISING SERVICE

The Commercial Section of the American Gas Association recently announced that it had made plans for instituting a uniqque merchandise service in the form of bulletins and reports, which will be furnished to the gas companies who subscribe for the same.

The new service is to be very comprehensive in nature, and is to consist of a regular systematic plan of disseminating information on various matters pertaining to the merchandising of gas utilities. In a certain way it is to be educational, but educational in a practical sense in that matters of a decided practical nature will be discussed and plans of operation will be outlined by men who have had considerable experience in the different fields which will be covered in the sales service.

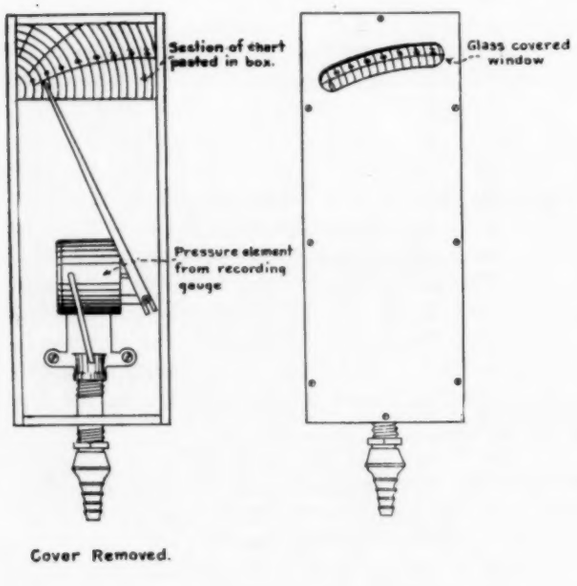
That this service is a good thing for the gas industry need scarcely be argued. Other industries have used merchandising service along various systems, and in general the results have been exceedingly good. It is not what might be called an innovation, but a plan which has been put to the test and found

GAS WRINKLES

PORTABLE PRESSURE GAUGE

F. E. Jinnett, Whittier, California

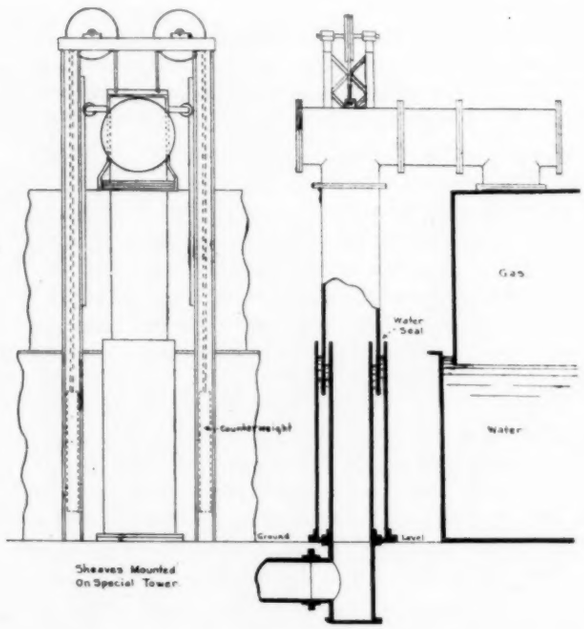
(To be Used Instead of Glass Water Column)



HOFFMAN INLET FOR GAS HOLDER

F. C. Morris, Denver, Colorado

(Method of Overcoming Small Outlet and Inlet Connections to Relief Holder)



to be eminently successful. The sales services, outlining selling plans and giving talks on the various essentials of salesmanship that the salesman must take hold of, if he is to be successful in his endeavor, have proven to be popular and to produce real results.

Some people have held that the salesman is born, and not made. It is true that a certain inherent selling sense must be present in a successful salesman, but it is also true that this germ of salesmanship is present in almost every man, whether he sells his services or sells commodities, and by the aid of education and training it can be enhanced and developed, with the result that a salesman is evolved.

Hence if the salesman can be made, it stands to reason that the principles of selling can be stated in comprehensive terms and taught to prospective salesmen. Furthermore, even the natural salesman, or one who does not need primary instruction, can obtain all sorts of valuable information on reading the investigation and reports of the efforts of successful salesmen.

The new sales service should therefore appeal to every salesman. It is designed with the idea of impressing upon the gas salesman that what he is selling is not appliances, but essentially a fuel, gas. Incidentally, of course, he sells appliances, but the main part of his business is to increase the consumption of gas through the sales of domestic and industrial gas appliances.

From our viewpoint, therefore, this sales service is admirable, and should be taken advantage of by every gas company in the country? It is something that the gas salesman needs, and something that he has not had an opportunity to obtain until the present time. Just as we have a catechism for the gas engineer, so this sales service will provide a catechism for the gas salesman.

Catechism of Central Station Gas Engineering in the United States

Installment No. 6

Principles of Generator Firing as Applied to Heating Retort Benches

31. What are the principles of generator firing as applied to the heating of retort benches, and why is it possible to obtain greater economy of fuel with such firing than with direct firing?

Ans. The basic principle of generator firing for retort benches is the division of the combustion of the fuel into two stages. The first of these, brought about in the furnace proper, results in the formation of a combustible producer gas, and the second consists in the burning of this gas in a combustion chamber provided for the purpose in the setting. To secure the best results, both as to the temperature that can be attained in the setting and as to economy of fuel, the amount of chimney draft and the total amount of air supplied for the combustion must be closely regulated, and the proper proportion must be maintained between the portions of the total amount used for primary air, or air admitted into the furnace, and for secondary air, or air admitted into the combustion chamber, respectively. The amount of primary air should be such as to form a good producer gas containing a maximum of carbon monoxide and a minimum of carbon dioxide, and that of the secondary air should be just sufficient to secure the complete combustion of this producer gas.

Complete Combustion of Fuel Is Necessary in Direct Firing

When solid fuel is completely consumed in one stage it is difficult to secure intimate contact between the carbon of the fuel and all the oxygen of the air supplied for its combustion, and for this reason, to secure even approximately complete combustion of the carbon, it is necessary to pass through the fire an amount of air largely in excess of what would be required if all the oxygen could be brought into contact, and made to combine, with carbon. In practice it is found that in direct fired retort benches it is necessary, in order to secure approximaately complete combustion of the fuel, to use, even under good conditions of working, between two and three times as much air as is theoretically required. The excess of air has to be heated up to the temperature of the furnace, and, since it is still highly heated when it leaves the setting, it carries away a large amount of heat which is thus wasted and the loss of which calls for the use of more fuel than would otherwise be necessary.

Only Partial Combustion Required in Generator Furnace

With a generator furnace only partial combustion of the fuel while in a solid state is desired, and this is effected with a limited supply of air, and the combustion is completed with the fuel in a gaseous state. In the case of a gas, intimate contact between the combustible and the oxygen of the air can be secured and the combustion can be made complete by the use of a very small excess of air over and above that theoretically required, this excess being as low as 10 per cent of the theoretical amount. There is thus a much smaller quantity of extra air to be heated up to escape while hot, and enough heat is saved in this way to make quite a difference in the quantity of fuel required for a given amount of work.

With a generator furnace it is also possible to have the combustion take place in closer proximity to the retorts, and therefore to have the heat produced act more effectively upon them than can be done with a direct fire furnace, and this leads to a further saving in fuel.

Bench of Retorts Equipped with Direct Fire Furnace

32. Give a description, illustrated with sketches, of a bench of retorts equipped with a direct fire furnace and describe the operation of the furnace, paying especial attention to the manner in which the fire should be handled in order to secure the most economical results.

Ans. A bench set with six retorts heated by a direct fire furnace, is illustrated on the accompanying cuts, which show a vertical cross section, a vertical longitudinal section and a horizontal section through the flues carrying the waste gases from the setting to the chimney flues.

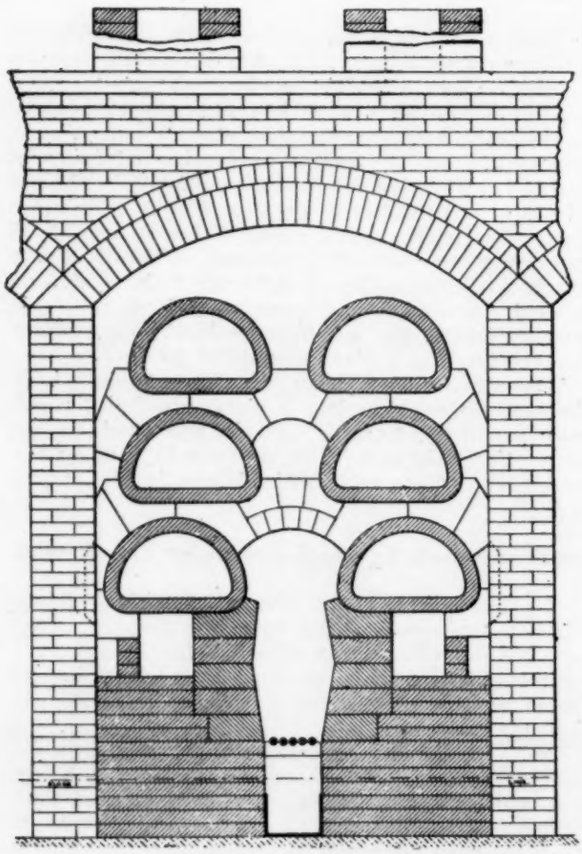
The setting, that is, the combination of retorts, furnace and flues, is built inside a space formed by two side walls, a back wall, in which are the chimney flues, and an arch springing from the side walls and covered with brick work to a depth of about two feet. Such a space is called an "arch." The brick work of the setting and that of the "arch" are entirely independent of each other, and the setting can be torn out and replaced at any time without affecting the arch.

Details of Construction

As will be seen from the cross section, the retorts, which are D-shaped clay retorts 14 in. × 24 in. × 9 ft. 0 in. long inside, are set in two almost vertical rows of three each, placed symmetrically with respect to the middle line of the setting. The upper retorts are drawn closer to the middle line, for the double purpose of exposing them more directly to the

radiant heat from the fire and of keeping their mouthpieces somewhat out of the way of the standpipes from the lower retorts.

Each bottom retort is supported on the inside, or side next the furnace, by blocks making a solid wall from the front to the back of the setting and constituting the top course of the furnace wall on that side, and on the outside by five blocks, each about 6 in.



Setting of Six Retorts With Direct Fire Furnace
(Cross-Section)

wide, one of which is placed at the back end of the retort, while the others are spaced between this and the front wall, as shown on the horizontal section. All of these blocks are shaped to fit the retort.

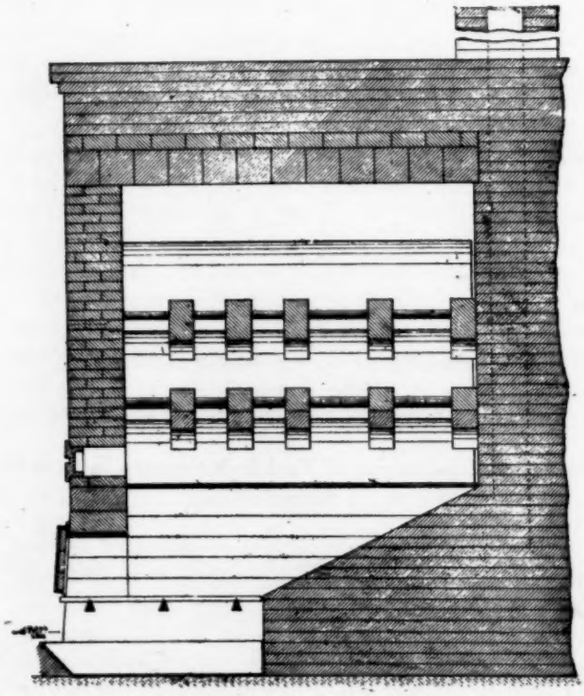
The middle retorts are suported by five sets of blocks, of the same width as the blocks described above, spaced in the same way from the front to the back of the setting and resting on top of the bottom retorts, and the top retorts by similar sets of blocks resting on top of the middle retorts.

Construction of Furnace

The furnace is built midway between the walls of the arch and with its walls parallel to these walls. At the grate bars it is 12 in. wide by 3 ft. 0 in. long and the width is increased to 18 in. at a point 17 in. above the bars and is then reduced to 14 in. at a height of 2 ft. 6 in. above the bars, which is that of the top of the walls between the bottom retorts. At the back it slopes from a length of 3 ft. 0 in. at the grate bars to one of the full depth of the setting at the top of the walls. Under the grate bars is an ash pan kept partly filled with water for the purpose of furnishing, by its evaporation under the influence of the heat radiated to it from the fire, sufficient steam to prevent the clinker from becoming too hard.

Distribution of Hot Flue Gases

The hot products of combustion rise from the furnace between the bottom retorts, after which part passes over between the top of the lower and the bottom of the middle retort on each side, while the remainder continues its upward course. Another



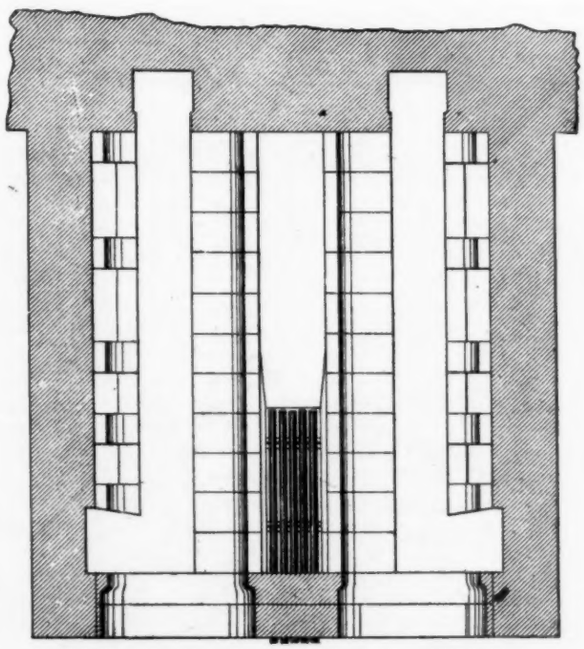
Setting of Six Retorts With Direct Fire Furnace
(Longitudinal Section)

part is taken off between the middle and the upper retorts and what is left is deflected over the tops of the upper retorts. All are finally drawn into the small side flues, which are situated, one on each side, next to the main flue under each bottom retort. By these side flues all of the hot gases, except a small part that is allowed to pass directly into the main flues by openings left underneath the retorts in the wall between the two flues, are brought to the front of the

setting and then led back through the main flues to the chimney flues in the back wall. These chimney flues are continued up to a height of four or five feet above the top of the stack. The proportion between the amount of hot gases passing directly into the main flues and that brought forward to the front, can be regulated so as to have the retorts uniformly heated from front to back, by adjusting the size of the openings between the side flues and the main flues by the insertion, into these openings as originally left, of bricks introduced through the main flues. This is done after the bench is heated up.

After the retorts are all set the "arch" is closed in by a front wall of fire brick thirteen inches thick, built around the retorts with its face flush with their fronts. Sight holes, closed with removable plugs, are left in this wall at the proper points.

Manner of Handling Fire to Secure Most Economical Results



Setting of Six Retorts With Direct Fire Furnace
(Horizontal Section Showing Bed for Bottom Retorts and the Waste Gas Flues)

In a direct fire furnace the carbon of the fuel is burned to carbon dioxide, CO_2, in one operation, which is practically completed in the fuel bed, and the retorts are heated principally by the sensible heat possessed by the products of combustion passing off from the fuel bed. It is therefore necessary to so handle the furnace as to produce the highest possible temperature in the fire itself. In fact, the fire should be handled very much the same as a boiler fire. The bed of fuel should not be made too deep, a depth of from fifteen inches to eighteen inches giving the best results. Fresh fuel should be added at frequent intervals, about once every hour, in order to maintain this depth constant and keep the fire from burning down too low. The grate bars should be shaken lightly from time to time so as to keep the bottom of the fire bright. The condition of this part of the fire can be determined by observing the reflection shown on the water in the ash pan. About twelve hours after the fire has been clinkered a slice bar should be run along the grate bars and the clinker that has formed there should be thoroughly broken up. Clinkering must be thoroughly done every twenty-four hours. It is impossible to use secondary grate bars when cleaning a furnace of this kind, and so after pushing as much of the fuel as possible up on the slope of the back wall the rest is dropped into the ash pan by drawing away the grate bars, the clinker is cut away from the side and back walls and removed from the furnace, the grate bars replaced, the fuel on the back wall drawn down and spread over the bars and fresh fuel charged into the furnace. The wear and tear on the furnace walls can be reduced by leaving an inch or so of clinker on them at all times, never attempting to take it off down to the brick.

Prevention of Air Leakage

To secure economy of fuel it is necessary to prevent any air from being drawn into the setting through cracks in the brick work and openings around the frame of the charging door and to be careful not to have an excessive draft. A direct fire furnace requires more draft to maintain the heat in the bench than does a generator furnace, but an excessive draft is bad in both cases. The appearance of flame at the top of the chimney flues indicates the existence of too much draft, and when it is noticed the dampers should be pushed in. All flues should be carefully cleaned out at least once a month in order to prevent any stoppages in them that would interfere with the keeping up of the heat, such stoppages being very frequently the cause of low heats when everything is apparently in good order.

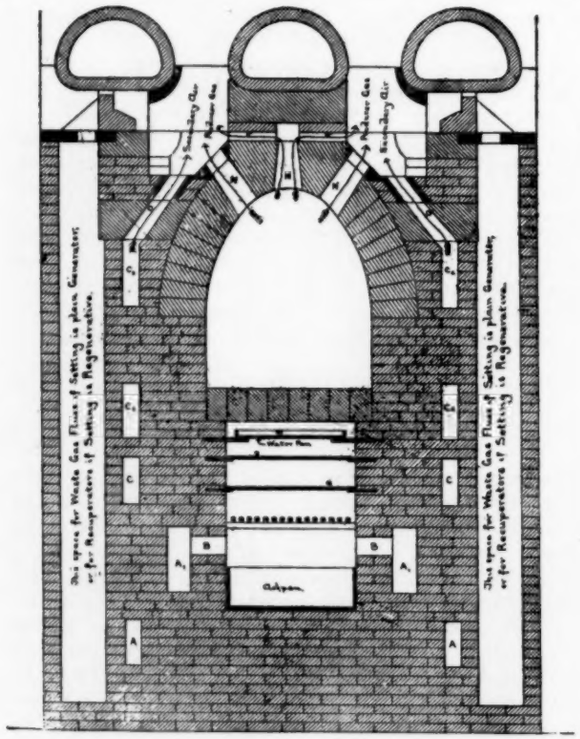
Description of Generator Furnace for Heating Coal Gas Retorts

33. Give a description illustrated with sketches of a generator furnace, either full depth or half depth, as applied to the heating of coal gas retorts. Pay particular attention to the points at which the primary and secondary air supplies are admitted, and the arrangements for filling the furnace, cleaning the fire and providing the steam required to keep the clinker soft, and do not omit sketches.

Ans. The accompanying cuts show a vertical cross-section and a longitudinal section of a full depth generator furnace, designed to heat a setting of 9 retorts. For a setting of 6 retorts the furnace would be made narrower and would have only one set of gas nostrils through the arch, this set being located along the center line, but otherwise it would be the

same. A half depth furnace would not be as deep as the full depth, but in other respects it would be practically the same.

This furnace is built directly beneath the setting which it heats. Its horizontal section is rectangular, 2 ft. 9 in. wide by 4 ft. 11 in. long at the grate bars, and increasing gradually to 7 ft. 5 in. in length at the crown of the arch 7 ft. 0 in. above the grate bars,

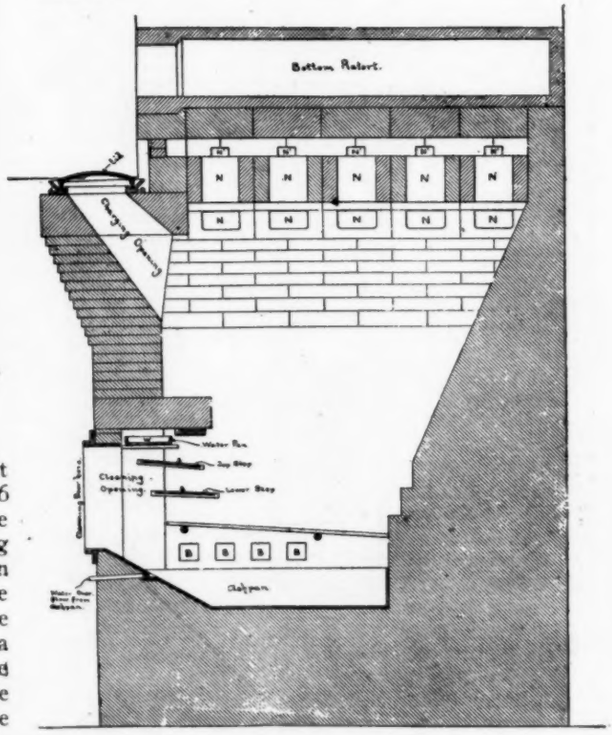


Generator Furnace
(Vertical Cross-Section)

while at a height of 2 ft. 0 in. above the bars an offset of 4½ in. on each side increases the width to 3 ft. 6 in. It is separated from the setting by an arch, the only communication between furnace and setting being through the openings or nostrils N, N, N, N, in the arch. As shown by the cuts there are in this case 15 of these openings in three rows of 5 each. One row extends along the top of the arch, and there is a row on each side a little down from the top. The arch is built of special arch blocks, but the rest of the furnace is built of fire bricks of the ordinary shape and size, those used for the inside lining being especially selected for hardness and ability to withstand the pounding and chipping of the clinkering bars, to which they will be subjected when the fire is cleaned. All the courses of the lining should be set as headers, since the brick if laid on stretcher courses will soon be cut through and knocked out of the wall by these bars.

Construction of Grate

The grate bars are made of wrought iron 1 in. square. Above the ordinary grate at the front of the furnace is what is known as a step grate. It consists of a cast iron water pan, W, placed above two steps formed of cast iron plates, S, S, both water pan and plates being supported by suitable brackets, built into the side walls of the furnace, in such a way that they incline towards the back of the furnace. The upper step projects beyond the inner edge of the water pan, and the lower step projects beyond the inner edge of the upper step. The function of this step grate is to supply, in connection with the ash pan, the steam required to keep the clinker soft and thus reduce the time and labor needed for cleaning the fire. For this purpose a small stream of water is kept running into the water pan over the inner edge of which it overflows, falling on the top step and running off this to the lower step, from which it falls into the ash pan. In this way a thin stream of water is exposed to the heat of the lower part of the fire by which it is evaporated, the steam so formed passing through the fire and reducing its temperature. The amount of water admitted must be carefully regulated.



Generator Furnace

(Longitudinal Section)

Immediately in front of the grate is the cleaning opening, closed tightly by a self-sealing door which is opened only when the fire requires cleaning.

(Seventh Installment Next Week)

GAS MERCHANDISING

Domestic – Industrial

A Few Merchandising Hints

William H. Matlack

IT HAS BEEN SAID

A rearrangement of stock and some new equipment will often brighten up a store at small expense.

——:o:——

A paste of talc or clay with diluted sulphuric acid makes a good polish for discolored nickel on gas ranges.

——:o:——

Nickel and other plated articles that are to be stored should be immersed in melted paraffin to prevent tarnishing. The thin film which congeals on the surface protects them from the air and may be easily washed off with hot water when they are required for service.

——:o:——

It is a mistaken idea that profits should be figured on the cost price. To estimate correctly, the per cent profit desired should be figured on the selling price.

——:o:——

Many an unfavorable impression has been created because the store was not clean. No matter how expensive the fixtures or how well the stock may be displayed, if cigar butts and cigarette stubs are strewn over the floor, and the counters are littered up with printed matter, an unfavorable impression is created and customers are repelled instead of attracted. A clean, well ventilated store creates a favorable impression and attracts new customers and holds the old ones.

——:o:——

A wide-awake merchant not only studies his merchandise and his customers, but he reads the trade magazines and other literature and books that deal with the business he is engaged in. Bradstreet reports that 86 per cent of business failures in 1918 could be attributed to personal responsibility, the principal cause being incompetency. No doubt many of these might have avoided the "toboggan" if they had "kept up on their calling."

——:o:——

The wise (sales) Commercial Manager gets on the firing line with his salesmen, now and then.

——:o:——

When goods don't move, don't be afraid to sacrifice both profit and a part of the cost of the goods. Use advertising judiciously,—the public needs, reads and heeds advertising.

——:o:——

When you want to make business easier, surer and have it come faster, display, push and advertise nationally advertised goods.

——:o:——

When you want to show a 15 per cent profit, figure it on your selling price; do not add 15 per cent to the cost price. Below is a table showing what certain per cents added to cost price will yield:

5% added to cost = 4¾% profit on resale price.

10%	"	"	"	"	9	"	"	"	"
15%	"	"	"	"	13	"	"	"	"
20%	"	"	"	"	16 2-3	"	"	"	"
25%	"	"	"	"	20	"	"	"	"
30%	"	"	"	"	23	"	"	"	"
35%	"	"	"	"	26	"	"	"	"
40%	"	"	"	"	28 1-2	"	"	"	"
45%	"	"	"	"	31	"	"	"	"
50%	"	"	"	"	33 1-3	"	"	"	"
55%	"	"	"	"	35 1-2	"	"	"	"
60%	"	"	"	"	37 1-2	"	"	"	"
65%	"	"	"	"	39 1-2	"	"	"	"
70%	"	"	"	"	41	"	"	"	"
75%	"	"	"	"	42 2-3	"	"	"	"
80%	"	"	"	"	44 1-2	"	"	"	"
85%	"	"	"	"	46	"	"	"	"
90%	"	"	"	"	47 1-2	"	"	"	"
100%	"	"	"	"	50	"	"	"	"

——:o:——

Enthusiasm helps a lot. If the merchant is enthusiastic about his goods and service, he attracts attention and folks soon begin to look to him for advice. Whenever such a merchant gets a chance, he adds another advertising idea to his plan. He never lets an opportunity to "tell folks how" to "do it better with gas" pass by.

If a salesman's mind is on industry he will make many installations where the industry had no idea "you can do it better with gas."

——:o:——

If a meter man or a fitter or a man from the works wants "to sell," restrict him not,—give him rope. Many star salesmen have been recruited from the ranks.

——:o:——

It is folly to send out envelopes half filled. A piece of direct mail advertising matter should be included in all mail leaving the store.

Don't Sell Too Small Water Heaters

The dangers that beset the gas man from this source

J. E. Bullard

THE tendency on the part of the average family is to use more and more hot water. The Saturday night bath is giving way to the daily bath. If no more bath rooms are added, more equipment is placed in the bath room. Shower baths are installed or needle and shower bath attachments made to the present bath tub. All this means more hot water requirements.

The plumbing trade is pushing the hot water idea. The medical profession, the health magazines, and just the common sense of the people, all advocate a cleanliness that means the use of more and more hot water.

Such things as these need to be taken into consideration when hot water installations are being made. If the heater is only large enough to meet the present needs of the family, there is every reason to believe that within a comparatively few years it will be inadequate to meet the hot water requirements. If, when it is installed, it is too small, the heating-hot-water-by-gas idea is given a setback.

To permit the installation of a single gas water heating that is not entirely adequate is bad for the gas industry. Such an installation as the following, for example, which was recently changed over to a proper installation, does a great deal of harm.

An Installation Which Was Too Small

A man who had money enough to buy anything he wanted had in his home, which contains six bath rooms, a circulating hot water system. A bare eighty gallon tank was used and the water heating was done with a small tank heater. When there were a number of people in the house there never was very hot water.

It is natural that this man should have been rather disgusted with gas water heating. However, the coal supply was uncertain, and he decided to give the gas water heating idea some consideration before deciding to install a coal heater. He called upon a number of concerns selling water heaters and was given different information by each and finally came to the conclusion that the only thing to do was to consult an engineer who knew something about water heating. He found the engineer.

The New Installation Was Adequate

The result was that the heating installation was completely changed. The small tank heater was replaced by a large automatically controlled storage heater. The tank was thoroughly insulated. The return hot water pipe was checked down to a point where there was merely sufficient circulation to keep the water in the flow pipe up to desired temperature.

When the installation was completed he give it a thorough trial and found that it met all requirements to his entire satisfaction. Now, there is always an ample supply of hot water in his house. No gas is wasted. It is an efficient and effective installation.

A Spirit of Pessimism Had Been Developed

However, this man was so pessimistic about gas heating that even after he had consulted the engineer and had the plans passed upon he would not contract for the installation without a guarantee that the installation would prove satisfactory. The concern putting it in had to agree to remove it and charge him nothing for the work done, if it failed to supply him with all the water needed under all conditions and at the temperature he desired. In other words, he would take no more chances in gas water heating experiments. He insisted that the person selling him the heater take all the chances.

Many Inadequate Water Heating Installations Can Be Found

Unfortunately, water heating installations that are inadequate are far too easy to find. They may not be so inadequate as this one, but there will generally be something missing.

Some years ago a gas company installed a tank water heater in the basement of a house occupied by a family employing one servant. This heater remained in place about six months, when, because of high gas bills, it became necessary to remove the heater and, to keep any gas in the house at all, to credit the consumer with the price paid for the heater and the cost of installing of it.

This was a case of an inadequate water heating system. It would have been far better for the company

and it would have sold more heaters in the long run had it never installed a heater in this house unless it could have first persuaded the owner to buy the proper kind. In this case the right installation would apparently have been a storage heater.

Water Heating Good Business for the Gas Company

Gas water heating is already a source of a desirable revenue for the gas company, but this revenue cannot be increased at the rate it should be, unless the installations made are satisfactory. The number of heaters sold do not determine the revenue. As a matter of fact, it may happen that a large sale of heaters may actually hold back the revenue.

That is, the company may be pushing one particular type and size of heater. During the campaign a great many of these are sold. Some of them at least are sold for doing work for which they are not fit. The people who buy these heaters, in place of some other type which they should have bought, are not going to be satisfied with them. They are going to feel that gas water heating leaves much to be desired. As a consequence, they are by no means going to boost gas. They are likely to advise their friends to use some other method, and the chances are that the most desirable business, if not altogether lost, will require the overcoming of great resistance on the part of the buyer that has been built up through the installation of a heater that should never have been purchased.

Install the Right Heater at All Times

The remedy is to make sure at all times that the heater is of ample capacity and of a type that will give entire satisfaction. There are some cases where the tank heater is entirely suitable; there are others where the storage system seems to be the only one that will fill the bill and there are still other cases where nothing will serve the purpose so well as an automatic.

Various Conditions Must Be Considered

If a man is willing to spend several hundred dollars for a hot water heating installation and requires an installation costing that much to give him the service he demands, it is foolhardy indeed to sell him a tank heater. If there is a laundry in a house, bath room and kitchen, and all the washing is done at home, and especially if there are many people in the family, an automatic heater, only large enough to supply a small stream of water to one faucet, is not going to prove at all satisfactory. The people in this house will not think of the convenience of the hot water supply. They really haven't a hot water supply. At best it will usually be a warm water supply. What they will think about will be the high gas bill they will have to pay.

On the other hand, if a heater of ample capacity, say one that will supply water to the kitchen, the laundry and the bath room at one and the same time is installed, the case is different. If when one goes into the bath room to shave or to take a bath, there is plenty of hot water, even though someone may be drawing water in the kitchen and also in the laundry, the satisfaction with the installation is so great that the gas bill will not figure.

The Size of the Family Is Important

The size of the family has to be considered as well as the number of faucets. Two people cannot use as much hot water as four or five, no matter how many faucets there are to draw hot water from. Therefore, a small heater will serve them admirably. But suppose these two people living in this house with one bath room have company. Let us suppose that it is a seven-room house and each of the four bedrooms are occupied by two people. It is obvious the small heater is not going to serve the purpose. Either a storage heater with a supply of twenty to forty gallons of hot water always on hand or an automatic of a size large enough to supply all the water all these people can draw will have to be installed. It must be borne in mind that it is while the house is full that the hot water heater helps to sell more or to build up barriers to future sales.

MAKING WATER GAS FROM BITUMINOUS COKING COAL

(Continued from page 119)

amount of steam is used in the reaction $C+2H_2O=CO_2+2H_2$, in which 18 pounds of steam produce 565 cubic feet of gas. There appears to be a limit, not the same for all fuels, below which the steam consumption can not be reduced profitably. It is desirable, from a consideration of generator conditions and blue-gas output only, to operate as near this limit as possible.

Heat Loss from Using Excess Steam

The heat loss due to employing an unduly large excess of steam per thousand feet of gas as made is as follows:

	lbs. per M.
Assume the steam used in a particular case is..	45
The actual steam required is, say.....	35
Unnecessary steam consumption is accordingly	10

The assumed value for steam consumption is not abnormal, but represents the actual figure frequently obtained in plant operation.

The steam leaves the checker chambers at approximately 1,350 deg. F. The total heat in 10 pounds of steam at 1,350 deg. F. and 1 pound pressure is, roughly, 17,350 B. T. U. The heat already furnished in the steam at 100 pounds pressure is $1,189\times10=$ 11,890 B. T. U. The loss of heat supplied from the generator per thousand feet of gas made due to this excess steam is 17,350 B. T. U.—11,890 B. T. U.=5,460 B. T. U. This is equivalent to 0.46 pound of coal per M. If the prevailing boiler practice is the evaporation of 7 pounds of water per pound of coal the total fuel loss per M. is $9.46+10/7=1.89$ pounds. This

amount of fuel can sometimes be saved by giving attention to unnecessary use of steam.

Oil Cracking—Carburetting

The statement has been made that the tarry vapors from the coal in the generator cause an increased amount of carbon deposits in the checker chambers, and particularly in the carburetor. This is probably true, but not to the extent that might be supposed. The quantity of carbon deposited, regardless of the kind of fuel used, depends on the method of operating, the oil used, the effectiveness or efficiency of the oil spray, and other factors. Since the oil-cracking efficiency (B. T. U. efficiency) is as great or greater than with coke fuel, and the tar yield is increased 20 per cent, it is possible that less carbon is deposited from oil cracking. With the excess steam that is commonly used with coal fuel, it is probable that some of it reacts in the checker chambers with hydrocarbons similar to the following: $C_2H_4+2H_2O=2CO+4H_2$. It is not known exactly to what extent these reactions take place or how much of the excess carbon deposited is from the tar.

Frequently, when additional carbon seems to be formed, the carburetor is blasted in such a way as to burn out most of it. This can be done quite effectively, but since in most gas plants no more blast air is available than is required for normal operation, use of an excess in carburetor will evidently rob the generator. Burning out carbon by blasting the generator is, therefore, undesirable if a more satisfactory method can be devised.

Method of Burning Out Carbon

The writer suggests a method that seems safe and efficacious. This consists of burning out the carbon by natural draft in the opposite direction; that is, opening a door near the bottom of the carburetor for an air intake and providing a means of exit for the CO_2 and N_2 formed during combustion at the top of the shell. A small door is also opened on the bottom of the superheater during this period; thus the carbon is burned out of this shell also and the checkers in it are not usually overheated, for the carbon deposit is small and the volume of air relatively large. The injection of steam to prevent overheating is not necessary.

Waste-Heat Boilers

Various kinds and types of waste-heat boilers have been used in water-gas plants with varying degrees of success. They may be divided in two classes, those utilizing the sensible heat of both blast and carburetted gas and those utilizing the sensible heat of the blast gas only.

Boilers of the former class have been failures so far. This is due chiefly to the fact that tar is deposited in the tubes or on them, according to the type of boiler, and not only decreases the boiler efficiency but necessitates frequent shutdowns for cleaning out. The so-called tar deposit is not tar, literally, but a carbonaceous pitchy mass, a distillation product of tar, and is removed only with difficulty.

Boilers of the other class have been operated with fair success. Some of the newer types have proved very effective in economozing the waste heat—sensible heat—of the blast gas.

Combustible Gas Produced in Excess of Requirements

Rate of blast:	Cu. ft.
First minute	1,600
Second minute (carburetor blast on)	1,200
Third minute (carburetor blast on)	1,200
Following ½ minute (carburetor blast off)	800
Total air used	4,800
Air blast for heating generator only	800
Per cent of total generator air	16 2-3

Since 1,500 cubic feet of air is normally used in the generator per thousand feet of finished gas made, the 4,800 cubic feet of air correspond to:

$$\frac{4,800}{1,500}=3,200 \text{ cubic feet of carburetted gas.}$$

The generator air per thousand feet used in excess of the requirements for generating produced gas (combustible blast gas) to heat the checker chambers then is:

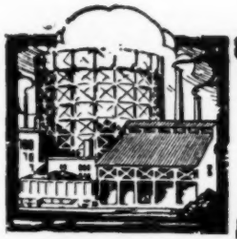
$$\frac{800}{3.2}=250 \text{ cubic feet.}$$

The blast gas that can be produced from this 250 cubic feet of air is approximately:

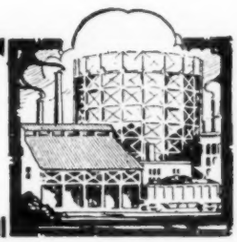
$$250\times1.3=325 \text{ cubic feet.}$$

Therefore there is available for use outside the water-gas set 325 cubic feet of 150 B. T. U. gas for every 1,000 cubic feet of carburetted gas made.

In actual practice, with a given set of conditions, the volume of gas available per thousand feet of gas made will depend primarily on the quality and quantity of the volatile matter of the coal, on the size and character of the coal used, and on the standard of quality of the finished gas. It is, of course, somewhat dependent on the method of operating and other variables. In actual experiments with coal fuel it has been found that more than 275 cubic feet of producer gas are so available. This figure was obtained with rather low temperatures in the generator and with less than 1,400 cubic feet of air per thousand feet to generator. When so operating as to increase the air per thousand feet to 1,500 cubic feet or more there will be more producer gas per thousand feet available for use outside the set. The temperature in the fuel bed should then be higher, if care is taken not to use more steam per thousand feet, and the output of finished gas per unit of time should be greater.



NEWS OF THE GAS INDUSTRY



Meeting of New England Association of Gas Engineers to Be February 13 and 14

The annual meeting of the New England Association of Gas Engineers will be held February 13 and 14 at the Copley-Plaza, Boston, Mass.

The program has been arranged as follows:

Wednesday, February 13—Meeting called to order by the president 10 a. m.; reading of the minutes of last meeting; report of the directors; election of new members; report of secretary; report of treasurer; reading list of deceased members; address of the president; report of nominating committee; address by Hon. Henry G. Wells, Department of Public Utilities of Massachusetts, subject to be announced; reports by representatives of the A. G. A.; discussion of subjects No. 1 and No. 2.

Paper, "Tar—Its Distillation and Crude Derivatives," J. H. Readio, Jr., of Providence, R. I.

Discussions of subjects No. 4 and No. 7.

Paper, "Continuous Inventory of Fixed Capital," A. J. Smith, Concord, N. H.

Entertainment for members, guests and ladies in the Swiss room, 8 to 2 p. m.

Thursday, February 14—Meeting called to order at 10 a. m.; paper, "The Gas Company as a Merchandiser—More Effort—More Sales," J. J. Quinn, Quincy, Mass.; discussion of subject No. 3; abstract of paper entitled, "The Action of Gas and Light Condensates, on the Oil in Diaphragm Leathers, with Particular Reference to the Bearing of the Action to the Kind of Diaphragm Oil," T. A. Mighill, Pawtucket, R. I.

Paper, "Backrun Apparatus at the Worcester Gas Light Company," E. H. Bauer, Worcester, Mass.

Discussion of subjects No. 5 and No. 6.

Subjects and questions for discussion: (1) Internal Corrosion of Holders; (2) Results of Liquid Purification; (3) Results of Changes in Method of Charging for Gas Service; (4) What Does Your Steam Cost per M at the Boiler? (5) Life of Steel Mains in Cities; (6) What is the Policy of the Companies in the Matter of Insurance? (7) Gummy Deposits in Distribution System.

Robert A. Carter, V. P. Consolidated Gas Co., Dies Suddenly

Robert A. Carter, vice-president of the Consolidated Gas Company, New York, N. Y., who was active in the gas companies' fight for higher rates two years ago, died suddenly February 4, in his room in the Union League Club.

Dr. T. A. Gonzales, assistant medical examiner, who was called to the club to issue a death certificate, said that Mr. Carter had been suffering for some years from heart trouble and had succumbed to a sudden attack.

Mr. Carter is survived by his son, Robert A. Carter, Jr., and his daughter, Mrs. Frank G. Smith. His wife, who was Helen R. Dinsmore of Brooklyn, died several years ago.

Mr. Carter was born in Brooklyn on December 3, 1860. On his father's side he was descended from Samuel Carter, who came to America from England in 1677. He was educated in the Brooklyn public schools and at the age of 16 began his business career as a junior clerk with the New York Gas Light Company.

Besides his position in the Consolidated Gas Company, Mr. Carter was treasurer, secretary and director of the Westchester Lighting Company, president and director of the Ball Electric Illuminating Company, treasurer and director of the New York and Queens Gas Company, controller of the Astoria Light, Heat and Power Company, treasurer of the Northern Westchester Lighting Company and Peekskill Lighting & R. R. Co.; director of the Untied Electric Light and Power Company, Yonkers Electric Light and Power Company, Municipal Lighting Company, National Coke and Coal Company, Central Union Gas Company and Northern Union Gas Company.

He was a member of the American Gas Association, National Electric Light Association, Illuminating Engineering Society, Metropolitan Museum of Art, Museum of Natural History, New York Botanical Society, Society of Colonial Wars and Anglo-Saon Lodge, F. and A. M.

Mr. Carter belonged to the Union League Club, City Club, Bankers Club, American Yacht Club, Oakland Golf Club and Sleepy Hollow Country Club.

To Issue Bonds for Improvements to Plants

The Old Colony Gas Company, which supplies gas to consumers in Hingham, Scituate, Cohasset and neighboring villages of Massachusetts, will issue $257,000 bonds to pay for extensions and additions to its plant.

Increases Capital

The New Haven Gas Light Company, New Haven, Ct., has added $500,000 to the capital stock, making the capital of the company $5,500,000. It is proposed to issue 20,000 shares of stock, par value $25, one new share to be issued for each 10 shares now held, payable in three installments.

Southern Gas Asosciation Meeting in April

Following is the tentative program of papers and entertainment:

"The Public Utility Employee's Place in the Activities of His Community," by Preston S. Arkwright.

"The Doherty Eystem of Sales Remuneration in the Gas Companies," by E. J. McGlinchey.

"Advertising and Selling Gas," by John Paul Lucas.

"How to Get the Greatest Benefit from an Association Meeting," L. I. Pollitt.

"Mechanical Aids in the Accounting Department," by F. A. Brine.

"How Best to Pass on the Information Contained in Gas Journals to the Employees," by A. D. Whittaler.

"Refractories," by A. F. Graves-Walker.

Tuesday afternoon, Augusta Barbecue and drive around the city; Wednesday morning, Bridge and Mah Jong for the ladies; Wednesday afternoon, golf tournament and reception at the Country Club with dancing, bridge and Mah Jong for those who do not participate in golf; Wednesday night, banquet and dancing; Thursday afternoon baseball game; Thursday night, not definitely decided upon.

Work Started on New Gas Plant

Worcester, Mass.—The Oxygen Process Corporation of New Enganld has begun work on the erection of the first unit of the demonstration gas plant which will be established at the works of the Worcester Gas Light Company on Quinsigamond avenue.

Corporation papers were taken out in Massachusetts. The company will have a capital of $250,000 preferred stock and 5,000 shares of common of no par value.

The officers are: President, E. A. W. Jeffries; vice-president, John W. Sheperdson; treasurer, Charles F. Morgan; clerk, George A. Gaskill; idrectors, these officers and J. Verner Critchely, Edgar W. Bassick of Bridgeport, Ct., Alfred Thomas and Chenoweth Housum.

The company will manufacture commercial gas by a process in which oxygen will replace air as used in the present product. The plant will be on a considerable scale with a capacity of from 600,000 to 900,000 cubic feet a day, which is about one-fifth the present output of the gas company. It will be received in the company's holders and distributed into the mains.

The first unit to be constructed will be the nitrogen set, which will separate oxygen from the atmosphere. Work will begin later on the gas generator, which is of the producer type now built by the Morgan Construction Company.

The process converts the bituminous coal into its gases and ash, instead of into gas and coke. It is estimated that 50 per cent more gas is extracted from coal than under present processes.

Thayer, Smith & Gaskill are attorneys for the new company.

Gas and Electric Consuming Appliance Sales of Cities Service Co. Show Large Increase for 1923

Final figures covering gas and electric consuming appliances reported by the New Business Department of Cities Service Company last year were $4,806,419. This was an increase of 46 per cent over the total 1922 sales, which amounted to $3,279,152.

The average appliance sale to each gas and electric customer in 1923 was $12, which is much better than the average of other companies operating in a similar field.

Miscellaneous sales made by Cities Service Company's New Business Department during the year totalled $1,309,974, making the total sales of all departments $6,112,392.

There was an increase of 30.9 per cent in the electric consuming appliance sales, which were $3,523,454, as compared with $2,691,162, while gas consuming appliance sales increased 135 per cent to $1,283,965 in 1923, as compared with $589,811 in 1922.

Gas Company Has Biggest Year

More improvements, including construction work at the plant and new gas main extensions, were made during 1923 than during any other year in the history of the Des Moines Gas Company, the total investment being about $425,000.

These additions to the plant and distribution system were made necessary, not only to take care of the present rapid growth of the city, but also to anticipate the increased demand for gas which is generally developing.

The gas industry is growing faster today than at any time in its history.

On December 13, 1923, the new gas tank or holder, having a capacity of 2,500,000 cubic feet, was put into operation. This will permit the storing of a reserve stock of gas which will insure the continuity of gas supply to the city during any ordinary interruption at the plant. The very latest apparatus for controlling and automatically operating the gas making machinery has been installed. This, with other additional apparatus, places the Des Moines plant in the front rank of the progressive gas companies of the entire country.

During 1923, on account of the demands for gas caused by the large amount of new building in the city, the company laid 98,523 feet, or 18.66 miles, of new gas mains, to which 1,744 new homes, office buildings, apartment houses, etc., were connected. The distribution system now includes 270.68 miles of gas mains, 28,985 services and 30,601 meters.

More gas was used in Des Moines during 1923 than in any previous year; 965,455,325 cubic feet were sold, as compared with 607,117,434 cubic feet in 1913, or a gain of almost 60 per cent. It is estimated that the volume of gas sold in 1924 will exceed 1,000,000,000 cubic feet.

Many gas consumers have purchased our cumulative preferred stock, thereby becoming part owners of the company. This means closer co-operation and a better understanding of the service which the company is rendering.

"Make This Your Thrift Year" Slogan of Illinois Power & Light Corporation Campaign

Chicago, Ill., Jan. 21—Every week this year will be "Thrift Week" for the customers and public in the territory served by the Illinois Power & Light Corporation, according to officials of the company. Commencing during National Thrift Week, this big power company launched a thrift campaign that will be waged throughout the entire year, officers of the company said here today.

"Make This Your Thrift Year" is the slogan that will be used.

The company has been conducting a customer ownership program which was responsible for the sale of over $2,000,000 of its 7 per cent preferred stock in the last four and a half months of 1923.

The company has adopted the thrift idea for its 1924 program because it believes that people purchase their home utility stock, either for cash or on a partial payment plan, for the good they will derive from being an owner of a dividend paying security. Utilities in the past have gone out and sold this stock to their customers on the basis of safety, good return, marketability and soundness of the industry.

The above are good features to stress, says the Illinois Power & Light Corporation, but a customer ownership program, to be of greatest value to the community, should go one step further and encourage the thrift idea with a definite saving plan, pointing out to the prospective investor the advantages wihch accrue to the individual who has saved a little money.

"The prosperity of a community is reflected in the prosperous condition of the utility that serves that community, and a utility which fosters the thrift idea is only striking a keynote in the prosperity of the territory in which it operates," declared E. Paul Young, head of the company's investment department.

"It is a round robin story. The community is prosperous, the people save and invest in the utility's stock, the money goes into the local banks and is checked out for improvements to the properties of the utility, which in turn provides the services which make the community more prosperous," he said.

As a start for its thrift campaign, the Illinois Power & Light Corporation released its slogan simultaneously in hundreds of newspapers in Illinois and ran this slogan for several days beginning January 14. This was followed by large display advertising in the newspapers, urging thrift and backing the thrift movement being sponsored by financial institutions, civic organizations, and by the general development program of the Y. M. C. A.

"The campaign, calling for the expenditure of thousands of dollars in newspaper advertising, will be continued throughout the entire year," Mr. Young declared.

"The company has mapped out a systematic drive that will tie in and co-operate with every agency backing the thrift movement for 1924 in the Central West states, which promises to be one of the most prosperous areas of the country this year," he said.

Utility Body Permits 5 Per Cent Bond Issue

Indianapolis, Ind.—The Public Service Commission authorized the Indianapolis Gas Company to deliver $118,000 of 5 per cent bonds to the Citizens Gas Company, lessor of the Indianapolis company and then authorized the Citizens Company to sell the bonds to reimburse its treasury for improvements to the Indianapolis company's plant made in 1922 and the first half of 1923. The bonds are to be sold at not less than 80 per cent of par.

The commission rescinded an order it had made authorizing Big Four trains to cross the Belt Railroad tracks near East Twenty-first street without stopping.

To Install New Equipment

The Connecticut Power Co., 175 Water street, New London, Ct., is preparing to erect a steel tank with a capacity of 1,000,000 cubic feet of gas, also two purifying boxes and a coke shed. Contract has been awarded to Stone & Webster, Inc. The cost will be about $60,000.

New Gas Schedules for Cohoes, New York

Albany, N. Y.—The Public Service Commission has approved a new schedule of rates for gas supplied by the Cohoes Power & Light Corporation for service supplied in the City of Cohoes and towns of Colonie and Waterford. The rate for gas used for lighting and fuel is reduced from $1.85 to $1.80 per thousand cubic feet. There is no change in minimum charge of 50 cents per month per customer. New rates are effective February 2, 1924.

Assume Duties With Public Service

Daytona, Fla.—George C. Mulligan, of Knoxville, Tenn., formerly with the Knoxville Gas Co., arrived in Daytona recently to assume charge of the sales department of the Daytona Public Service Co. Mr. Mulligan will handle the entire line of the local concern.

Prior to his connections in Knoxville, Mr. Mulligan was with the Savannah Gas Co.

Earl C. Butler Elected Director of Middletown Gas Light Co.

At the annual meeting of the Middletown Gas Light Co., held January 21, at Middletown, Ct., Earl C. Butler was elected a director to succeed the late Frank Smith. All the other officers and directors of the company were re-elected.

C. K. Billings, Jr., Makes Change

C. Kingsbury Billings, Jr., who has been in charge of the New Haven office of H. M. Byllesby & Co. for a number of years, has become associated with the firm of Winslow, Day & Stoddard, of New Haven. The office of H. M. Byllesby & Co. in New Haven has been

New Installation at Rocky Mount, North Carolina

The gas department of the Rocky Mount Public Works is now installing a 130 h. p. water tube boiler with feed water heater, building new boiler room and erecting a 110-foot brick stack at its plant at a cost of $18,000.

Current Market Prices

COALS (By Courtesy of Coal Age)

A. Bituminous.

(Spot prices, F. O. B., mines, net tons).

High Volatile, Eastern	Market	Price
Pool 54-64 (Gas Standard))	New York	$1.50 to $1.75
Pittsburgh screened gas	Pittsburgh	2.50 to 2.65
Pittsburgh gas, mine run	Pittsburgh	2.25 to 2.35
Kanawha lump	Columbus	2.50 to 2.75
Kanawha mine run	Columbus	1.50 to 1.75
West Virginia lump	Cincinnati	2.75 to 3.00
W. Virginia gas mine run	Cincinnati	1.65 to 1.85
Midwest		
Indiana 4th vein lump	Chicago	3.00 to 3.25
Indiana 4th vein mine run	Chicago	2.50 to 2.75
South and Southwest		
Big Seam lump	Birmingham	3.75 to 4.00
Big Seam mine run	Birmingham	1.75 to 1.85
Southeast Kentucky lump	Louisville	3.00 to 3.50
Southeast Kentucky mine run	Louisville	1.65 to 2.00

B. Anthracite.

(Spot prices F. O. B. mines, gross tons),

Market	Freight rates	Independent	Company
Egg New York	$2.34	$8.50 to $9.25	$8.75 to $9.25
Egg Philadelphia	2.39	8.50 to 10.00	8.75 to 9.25
Egg Chicago (net tons)	5.06	7.50 to 8.80	8.00 to 8.35

COKE (By Courtesy of Iron Trade Review).

Connellsville, furnace	$3.75 to $4.25
Wise County, furnace	4.50 to 5.75
Alabama, furnace	5.00 to 6.00
Foundry, Newark, N. J., del	10.91
Foundry, Chicago, ovens	12.50
Foundry, Boston, delivered	12.50
Foundry, St. Louis	12.50
Foundry, Granite City, Ill	12.50
Foundry, Alabama	5.00 to 6.50

PETROLEUM (By Courtesy of Oil, Paint & Drug Reporter)

(Prices at wells, per bbl.)

Pennsylvania—Ohio—West Virginia.	
Cabell, West Virginia	$2.05
Corning, Ohio	1.80
Lima	1.93
Pennsylvania	4.00 to 4.50
Wooster, Ohio	1.80
Indiana—Illinois.	
Illinois	1.72
Indiana	1.73
Oklahoma—Kansas.	
Healdton	.90
Mid-continent (low gravity)	.75 to .90
Gulf Coast.	
Gulf Coast, Grade A	$1.65
Gulf Coast, Grade B	1.40
Pierce Junction	.65

GAS OILS.

Gas Oil, Bayonne, bulk gal	5 to 5¼c
Gas Oil (32-36) Illinois-Indiana, gal	3¼ to 3½c
Gas Oil (32-36) Oklahoma, gal	3½ to 3¾c
Gas Oil (32-36) Gulf Coast, gal	4½ to 5 c

PIPE AND FITTINGS—CAST IRON GAS PIPE.

(By Courtesy Iron Trade Review.)

Four-inch, Chicago	$66.20 to $67.20
Six-inch and over, Chicago	62.20 to 63.20
Four-inch, Birmingham	56.00 to 57.00
Six-inch and over, Birmingham	52.00 to 53.00
Four-inch, New York	70.60 to 71.60
Six-inch and over, New York	65.60 to 66.60
Standard fittings, Birmingham, base	115.00

6 to 24-inch, base; over 24-inch, plus $20; 4-inch, plus $20; 3-inch, plus $20.

BY-PRODUCTS

(By Courtesy of Oil, Paint and Drug Reporter)

Ammonia aqua, 16 deg. drums lb	5 to 5½c
Ammonia aqua, 20 deg. drums lb	6¼ to 7 c
Ammonia aqua, 26 deg. drums lb	7 to 7½c
Ammonia squa, anhydrous cylinder, lb	30 to 36 c
Ammonium sulphate, bulk F. O. B. Works, per 100 lbs	$2.90 to $3.00
Potash prussiate, yellow casks, lb	21 to 22 c
Potash prussiate, red casks, lb	45 to 48 c
Soda prussiate, yellow casks, lb	13 to 13½c
Soda sulphocyanide, barrels, lb	45 to 55 c

COAL TAR BASIC PRODUCTS.

(By Courtesy of Oil, Paint and Drug Reporter)

Benzol C. P. tanks, works, gal	23 to 28c
Benzol, drums, gal	28 to 33c
Benzol, 90% tanks, works, gal	21 to 26c
Benzol, 90% drums, gal	26 to 31c
Napthalene, flake, barrels, lb	6¼ to 7c
Napthalene, crushed bags, lb	5½ to 6c
Solvent Naphtha, water white works, gal.	27c
Solvent Naphtha, drums, works, gal	32c
Solvent Naptha, Crude Tanks, works, gal.	24c
Solvent Naphtha, drums, works, gal	29c
Toluene, C. P. tanks, works, gal	26c
Toluene C. P. drums, works, gal	31c

Larger soft coal production than ever before attained at the present season of the year is reported by the Geological Survey. Buyers are coming into the market with more regularity. Much quiet buying is taking place. The week's production was around 11,500,000 net tons. No considerable change in prices is expected as a result of the conference of miners and operators unless operations cease on April 1. There are large reserve stocks of soft coal available.

Prices of petroleum continue to mount. The period of declining production is about over. The consumption of gas oil is reported as normal and its price advances along with those of all sorts of refined products.

There has not been much change during the past week in the prices of by-products and coal tar products.